Oddělení diodově čerpaných laserů a realizační tým projektu HiLASE
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Interaction of ultraintense laser pulse with plasmas for the generation of a high energy proton beam and an ultrashort x-ray pulse

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Interaction of an ultra-intense laser pulse, or a laser pulse with a relativistic intensity, has been attracted not only by its fundamental aspect but also its possible applications in the generation of high energy particles and an ultra-short x-ray pulse. We have investigated the generation of high energy proton beams from thin foil targets irradiated by a 30 TW, 30 fs, Ti:Sapphire laser pulse. According to the observation of more energetic proton beams from plastic foils than those from metal foils, an acceleration model, ARIE (Acceleration by a Resistively Induced Electric field) has been proposed. Subsequent experimental observations on the level of the laser pre-pulse and target thickness are well described by the model. An experiment with an aluminum-coated plastic target has been conducted by irradiating the laser pulse on the aluminum side and the plastic side. The results, when interpreted with a two-dimensional PIC (Particle-In-Cell), suggest that the energetic part of the proton beam from plastic target originates from the front side of the target. It is also interesting to consider highly nonlinear interaction of an ultra-intense laser pulse with a relativistic electron beam. Such a nonlinear interaction, originated by relativistic driving of the laser pulse, leads to a generation of an x-ray pulse with wide spectral range. The so-called RNTS (Relativistic Nonlinear Thomson Scattered) radiation has been investigated numerically, which shows that it makes it possible to generate an attosecond x-ray pulse. Also, it has been found that the effect of the high-order fields of the focused laser beam is significant on the scattered radiation.

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